EGU General Assembly 2022

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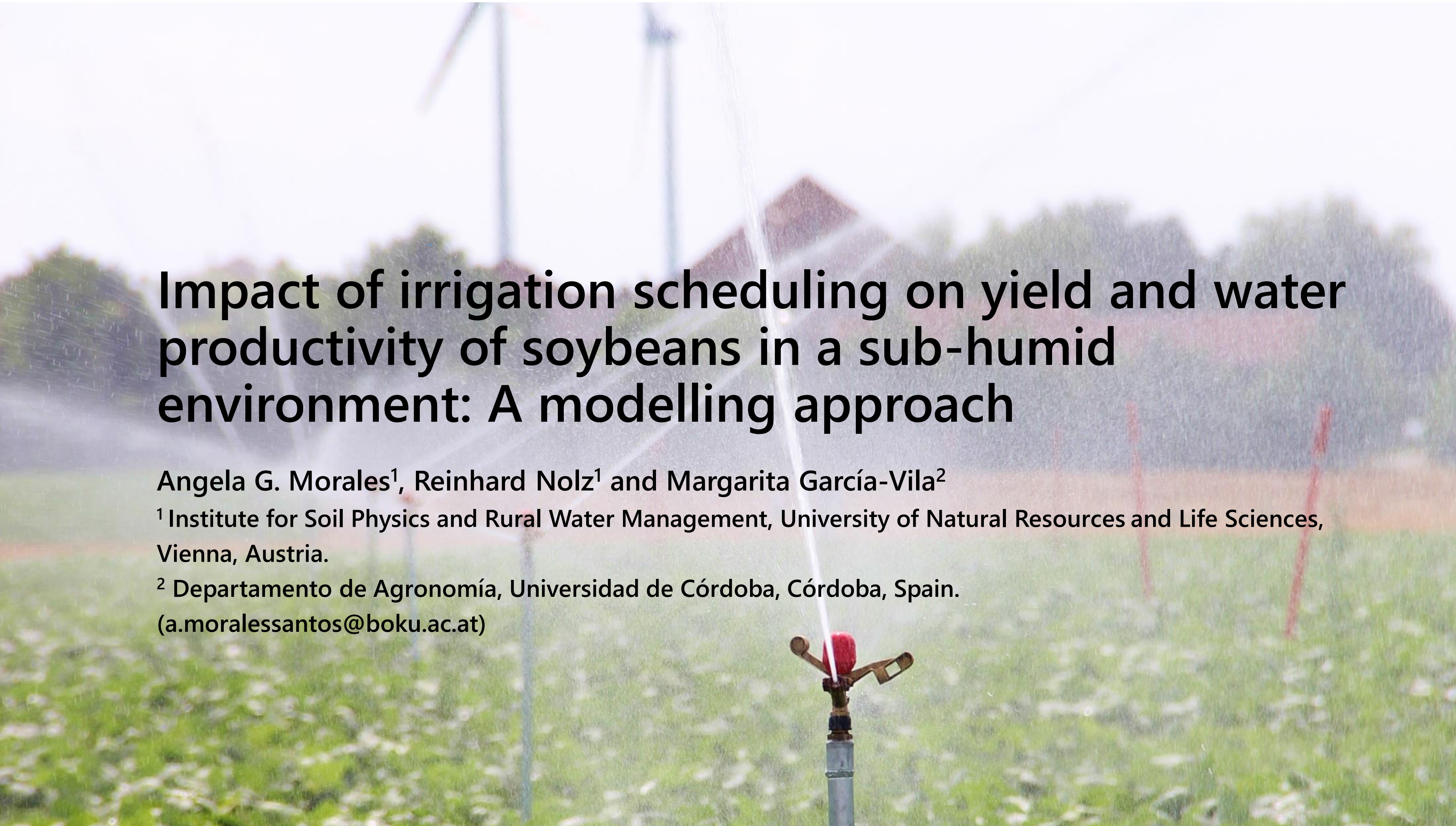

Impact of irrigation scheduling on yield and water productivity of soybeans in a sub-humid environment: A modelling approach

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Applied for Outstanding Student and PhD candidate Presentation (OSPP) Award

Introduction

- Increase irrigation requirements due to climate change
- Irrigation based on farmers' experience vs. soil status
- Irrigation scheduling can be evaluated by simulations of yield response to water

Objectives:

- ❑ To evaluate irrigation management strategies traditionally used by farmers in Austria.
- ❑ To propose irrigation scheduling scenarios that increase water productivity.

Methods

Fig. 1a. Drip irrigation (DI)

Fig. 1b. Irrigation boom (BI)

Fig. 1c. No irrigation (NI)

Fig. 1d. Sprinkler irrigation (SI)

Field and lab measurements

- Climate
- Crop development
- Soil physical characteristics
- Irrigation dates and amounts

FAO model AquaCrop

- Parameterization (2019)
- Validation (2018)
- **Net irrigation requirements (NIR)**
- **Development of irrigation scenarios**

Assessment of irrigation scenarios

- **Irrigation water used (IWU)**
- **Relative yield reduction (RYR)**
- **Water productivity (WP)**

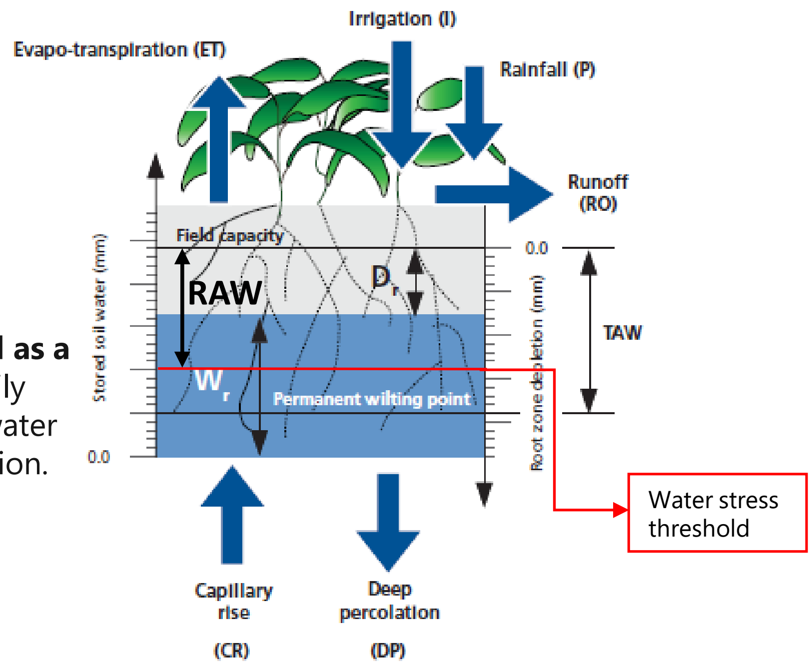


Fig 2. Root zone depicted as a reservoir. RAW is the readily available water, Wr is the water depth, Dr root zone depletion.

Source: modified from FAO Irrigation and Drainage paper No. 66 (P. Steduto et al., 2012)

Results

Fig. 3. Probability of exceedance of Net irrigation requirements for the 1990 – 2019 series.

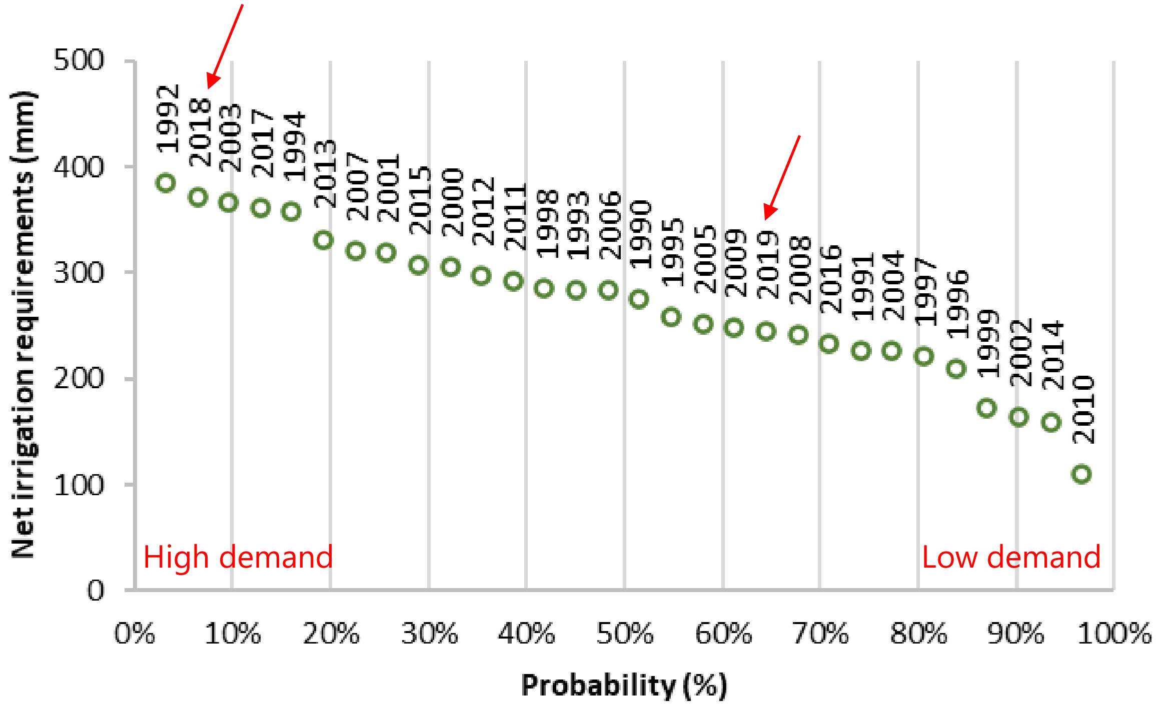
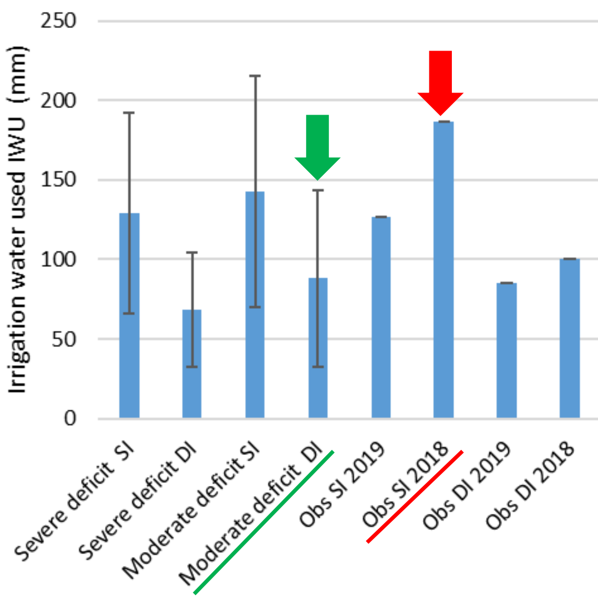


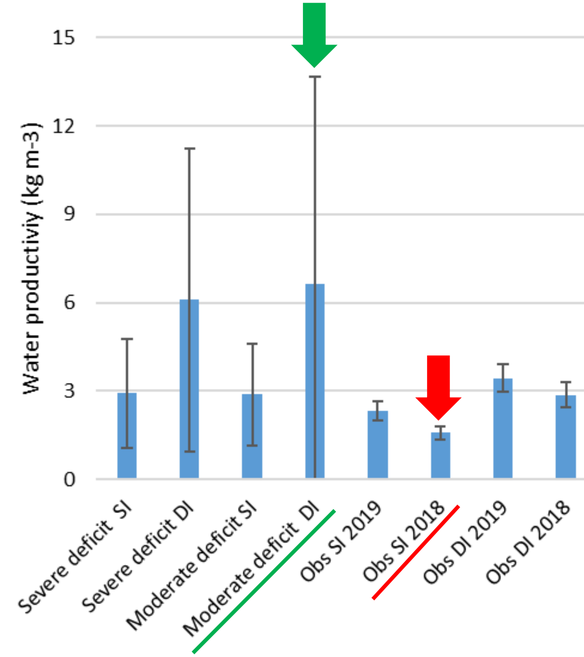
Fig. 4. Irrigation scenarios.

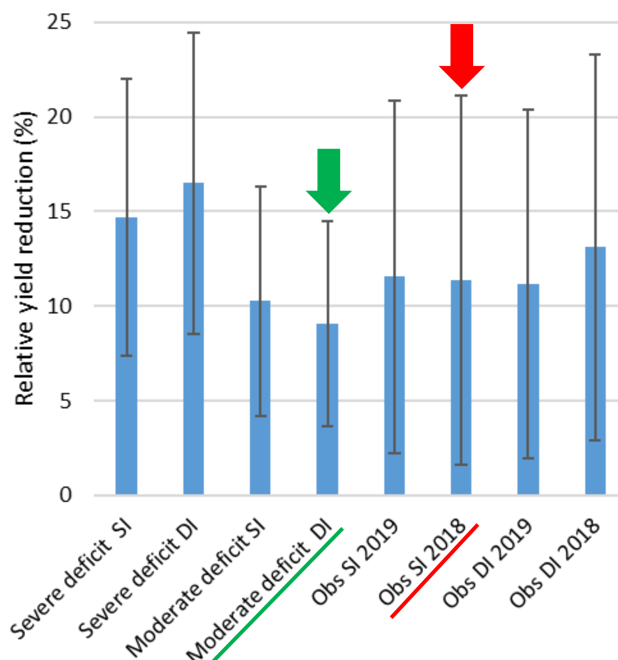
Severe deficit for drip and sprinkler	• Deficit of 180 RAW entire season.
Moderate deficit for drip	• Deficit of 150 RAW during vegetative and 140 RAW during flowering.
Moderate deficit for sprinkler	• Deficit of 170 RAW during vegetative and 160 RAW during flowering.
Observed	• Irrigation based on farmers' criteria.

Scenario in 2018	**Plot**	**Irrigation water used IWU (mm)**	**Yield (kg ha^{-1})**	**Relative yield reduction RYR (%)**	**Irrigation Water productivity (kg m^{-3})**
Observed	DRIP	100	3331	31	3.33
Severe deficit	DRIP	67	3238	34	4.86
Moderate deficit	DRIP	133	3758	19	2.82
Observed	SPRINKLER	187	3434	28	1.84
Severe deficit	SPRINKLER	150	3430	28	2.29
Moderate deficit	SPRINKLER	200	3792	18	1.90
Observed	BOOM	152	3541	25	2.33
Observed	NO IRRIGATION	0	2757	49	-
Net irrigation requirement	-	370	4374	0	1.18

Fig. 5. Results of long-term series 1990 – 2019







Conclusions:

- The adoption of a moderate deficit with drip lines is likely appropriate to apply in the study area, without affecting yields, despite a reduction of water productivity.
- Proper application of deficit irrigation requires technical support to farmers' decisions regarding irrigation timings.

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